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The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI April 1949 No. 4

Editorial

Raw Cotton Production: The Partition of India and the compulsory curtailment of cotton acreage during the war have very adversely affected the raw cotton production of the Indian Union. Recent reviews of cotton stocks and the distress appeals preferred by the Textile Industry for the improvement of the tight raw cotton supply position to mills are sufficient pointers to indicate that we are heading towards a cotton famine. The factual position for the cotton year 1948—'49 as announced on the floor of the parliament placed the mill consumption at 46 lakh bales and extra factory consumption at 2·7 lakh bales. The total requirement of 48·7 lakh bales was proposed to be met from the domestic production of 26 lakh bales, carry over stocks the extent of 10·9 lakh bales, Pakistan supply of 6·5 lakhs, East African imports of 2 lakhs and supplies from U. S. A., Brazil, Egypt and Sudan amounting to 3·3 lakh bales. These arrangements would help us in tiding over the present crisis but the rate at which we are eating into the carryover stocks would only put off the evil day. In fact it is apprehended that we will be unable to tide over the period between September and December 1949 without adequate imports.

The policy of the Government in regard to raw cotton has been criticized by the trade who hold the view that looked at from any angle, the policy has miserably failed. The ceilings fixed by Government remain only on paper and business on lint has considerably thinned. The market for cotton is one of trading in seed cotton which can be purchased at substantial premiums over the ceiling parity without infringing the law. Many mills have been forced to adopt this device and sacrifice part of their manufacturing margins. The less resourceful smaller mills are compelled to notify closure or curtail employment of labour.

The Government reviewed the cotton production and price structure for the ensuing year at a recent meeting in Delhi where all interests were represented. The target of cotton production for 1949—'50 has not yet been announced but plans are afoot to raise the acreage by about two million without in any manner affecting the

Food programme. It is also stated that an expert committee is working out the differentials in prices between different varieties of cotton on the basis of merits, and that their decisions will be made known by the end of this month.

There is a case for raising the ceilings of cotton so as to bear a fair relationship to the cost of imported cotton. The very fact that many of the mills are able to pay prices higher than the controlled rates proves that an upward price revision is quite possible. There is plenty of force in the remarks of the President of the East India Cotton Association who stated "to make frantic efforts to depress the price of Indian Cotton and to send Cotton Missions abroad for the purchase of cotton at relatively much higher prices is an absurdity." Unless a sound cotton policy is framed, India will be forced to expend her sterling and dollar exchange for a commodity which as exportable surplus helped her to maintain a favourable balance of trade in pre-war years.

An analysis of the post-war needs of the Mill Industry in Madras, would place the ultimate consumption at 425,000 bales in each of American and *desi* cottons Madras will be obliged to double her production, increase the output of quality American and convert all short-staple into medium staple cottons. In such a drive, the gaps in production can either be made up by higher yields per acre or increase in acreage. The methods must suit the conditions of peasant farmers who form the bulk of the cotton growers in the province and whose joint contribution even at small levels of increase will ultimately result in a substantial over-all production without the need for providing vast amounts for capital expenditure or special equipments. There are certain tested cultural practices and crop mixtures which if extended to both the cotton and the non-cotton growing regions, will affect to a very large degree the production deficit. Improvement of irrigation sources in cotton areas where the lands are subject to intensive cropping will materially augment production. Utilisation of rice fallows in deltas and rainfed regions is a long range plan which is likely to yield a good dividend. Madras with the sanction of four new breeding schemes and plans for increasing the acreage and the supply of certified seeds to the cultivators will eventually be able to draw her full requirements from the internal growths. This together with plans for extension of area under irrigated cotton in East Punjab, (including the adjoining states) and Mysore will it is hoped raise India to her former place in the cotton growing countries of the world.

A Study of Arecanut Production in South India

By

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Ranked as one of the principal commercial crops of South India, the arecanut *(Areca catechu)* has also been a very popular masticatory all over this country from times immemorial. Either by itself in its varied fresh or processed forms or in combination with the leaves of the betel vine *(Piper betel)*, a little lime and sometimes with also pieces of clove, nutmeg, tobacco etc., the arecanut has become an almost invariable feature of Indian hospitality. "*Pansupari*" is the name by which this dessert or after-dinner masticatory is known all over India, representing perhaps the largest common factor in the dietary habits of the people of this sub-continent. In rituals and offerings too, the nut or inflorescence of the areca palm has gained for itself a great prominence in South Indian life, so that this crop is entitled to be reckoned as an essential part of the life and living of the inhabitants of this part of the country. A study of this crop and its production methods will have, therefore, an interest and value from the view points of the South Indian economy no less than that of the social life of the region.

Historical. Grist (1926) has stated that the betelnut which is synonymous with arecanut, has been a source of trade between India, Ceylon, Indonesia and Malaya from the remotest periods of history. The belief has been held that Malaya might perhaps be the original home of this nut. Sands, quoting from Ridley's book on "Flora of the Malay Peninsula" provides evidence to the contrary, since Ridley had never seen the palm in a wild condition in Malaya nor did it aspear to establish itself outside cultivated ground, though he has recorded that the palm was under cultivation in Malacca before 1593. A more ancient reference to the palm is found in a Chinese work dated 140 to 80 B. C. under the name Pinlang, which is evidently a perversion of Pinang. The affinity of this term to "Penang nut" which is the name by which arecanut was widely known in Malaya Peninsula and Sumatra may be obvious. It seems also obvious from these and other facts that the palm was existing in Malaya and possibly in Philippine group of islands from historical times. Beccari, however, is definite that in no other part of Asia or Malaya, excluding the Philippines, was any species of areca found or any other species remotely similar to the *Areca catechu*. Till more

evidence comes to light, the original home of the palm as also the date of its introduction into India has to remain shrouded in mystery, the only possible surmise is that the nut was probably brought into this country by the Indian labourers for chewing purposes from the Philippines (4) or from Ceylon

Trade. According to Grist, arecanut formed an important exported commodity from Ceylon to India and was the chief medium of exchange for the grain which the natives of Ceylon have for centuries drawn from Southern India. From the figures furnished from Calcutta (3) for 1918—1919, the foreign trade in this nut for the whole of undivided India was as under.

Exports.		*Imports.*	
Quantity	Value	Quantity	Value
3,62,419 lbs.	£. 8,119	142,527,683 lbs.	£. 1,141,269

The imports to Madras Presidency in recent years can be gauged from the following figures supplied by the Provincial Marketing Officer, Madras.

Year.	*Imports in Cwts.*	*Value in Rupees.*
1938—1939.	2,79,801	not known
1944—1945.	74,236	32,79,337
1946—1947.	1,41,629	more than a crore.

From the foregoing it may be concluded that the country is very much in deficit in respect of the nut, and there is therefore a very considerable headway to be made in stepping up the production. That even the leading areca producing province like Madras should be dependent on outside sources for her areca supply to the tune of more than a crore of rupees, is a feature that should set everyone thinking on the methods necessary for bridging the gap between the demand and production. In the case of a crop like areca, for the production of which, ideal conditions exist in South India, there is no possible reason why production cannot be augmented, not merely to make South India self-sufficient but also to cater to the huge demand in other parts of the country. This is a line of development that seem to deserve urgent consideration in our national crop-planning.

Production. The Provincial Marketing Officer, Madras, has estimated that the Madras Presidency produces annually, 5,45,150 cwts. of arecanut valued at Rs. 5,45,15,000 (1946—47). This is from an

estimated area of 1,07,000 acres which works out to an acre yield of about 5 cwts. The figures of acreage under areca as furnished by the Special Officer, Arecanut Survey, Ernakulam, are presented below:

Assam	...	...	27,200 acres.
Bengal	...	...	5,700 ,,
Bombay	...	...	19,400 ,,
Cochin	...	...	24,400 ,,
Coorg	...	...	800 ,,
Madras	...	...	1,07,000 ,,
Mysore	...	...	37,100 ,,
Travancore	...	...	40,000 ,,
Other parts	...	...	1,800 ,,
		Total ...	2.63,400 acres.

In acreage and money value, the areca occupies even at present an important place in the economy of this Province. Considering the need for the extension of production and the possibilities thereof, it would appear that areca is a crop that deserves more attention than that it enjoys at present. Such attention has to be based mainly through planting of additional area and by effecting improvements in production methods. It has to be noted that at present South India claims 79·5% of the total areca area in the country which fact entitles the crop to be deemed as of chief importance to this region. Any work designed to foster greater and better production of the area should, therefore, be conceived principally against the background of South India's peculiarities and potentialities.

Out of the total area of 2,63,400 acres of arecanut grown in the Indian Union, 1,07,000 acres are in Madras Presidency alone and 2,09,300 acres in South India including Cochin, Travancore, Mysore and Coorg, that is 79·5% of the total area. It has already been pointed out, how Madras is importing more than one crore of rupees worth of nuts every year and how important it is to make the province self-sufficient in arecanut. There is scope for tackling this problem both by increasing the area and improving the yield of the existing gardens.

It should be noted that practically no work has been done on the improvement of arecanut in India except the work to control "*Mahali* disease". As such there is practically no literature available

on the various aspects of the arecanut crop. It is time that serious attention is paid to the improvement of this important commercial crop and it is really good news that the Government of India have taken up the matter and appointed an Agricultural Officer to conduct a survey of the crop. It is hoped that a separate committee like the Indian Central Coconut Committee, will be started soon with research stations for the improvement of arecanut.

The areca palm is widely distributed in tropical countries where climatic conditions are suitable for its growth. It is grown in India, Ceylon, Federated Malay States,, Straits Settlements, Sumatra, Java and other East Indian Islands.

Uses of Areca. The uses of the palm are many. The most important is the nut which is used chiefly as a masticatory by the people of Eastern races and with the natural increase in population the demand for the nut is steadily increasing.

Sands (1926) has recorded — "To the taste the nut is astringent and slightly acid; it possesses also narcotic and anthelmintic properties. These properties are due mainly to the alkaloid "Arecoline"; but three other closely allied alkaloids have also been isolated. The alkaloids are said to occur in the light coloured endosperm and not in the dark brown or red portions which contain the colouring matter."

The powdered nut owing to its astringent action on the gums is used as a dentifrice and in veterinary practices as an anthelmintic. The nut when boiled with water gives a decoction and this is used in the preparation of dyes, in tanning and in the preparation of catechu. The stem is used as rafters and pillars for sheds and also as fuel. The leaves are useful as fuel and the midribs for the preparation of brooms. The leafsheaths are used as plates and for the preparation of hand tans, caps, packing material etc. The roots are used in medicine (5).

Description of the Palm. For an understanding of the areca production methods, it will be useful to have an idea of the growth and fruiting habits of the palm.

The palm is unquestionably one of the graceful plants, with an appearance and dignity all its own. The sight of the areca plantations skirting the ghat road from Mettupalayam to Ooty is a sight never forgotten by those who enjoyed it. Even in a home garden or a park,

the clean and supple stem rising to great heights with straight lines add a beauty which is an asset whether as individual specimen or in groups as in avenues.

Sands has recorded that the palm reaches a height of 60 feet but in South India much larger heights are not infrequently seen. The stem is cylindrical, 5 to 8 inches in diameter and ringed distinctly from the base upwards by the scars of the fallen leaves. The stem is green when young but assumes a greyish colour with age. The stem is tough and strong and is not readily broken by wind. It is held up by strong roots both above and below ground. The crown of leaves is compact with a diameter of about 8 feet. The leaves are pinnate from 4 to 6 feet long with a long sheathing base which completely encircles the stem. The leaflets are numerous, 1 to 2 feet long, 1 to 1¼ inches wide, some of which may remain joined together.

Flowering. Under favourable conditions the palm commences flowering when it is about 4 years old. Each inflorescence or spadix is closely covered by a leaf sheath until a few days before it is ready to open Further, the spadix is completely enclosed in a sealed, double boat shaped, flattened spathe about 2 feet long and 7 inches wide in its broadest part. The inner and the upper side of the spathe is much thinner and weaker than the outer and the lower side, so that the expanding spadix easily bursts the spathe open along its upper side in a central longitudinal line and frees itself.

The spadix is short stalked, 1½ to 2 feet long, with numerous branches and unisexual flowers. Each secondary or tertiary branch bears one to several female flowers near its thickened base; whilst an abundance of male flowers are produced on special filiform branches, 6 to 10 inches long, which arise below and extend beyond the female flowers. The male flower is small, 1/8 inch long, sessile, triangular, white, with three minute sepals and three larger, stiff, lanceolate petals. The stamens number six and contain very minute, colourless pollen grains. The rudimentary ovary is trifid and slightly longer than the stamens.

The female flower is 1/2 to 5/8 inch long, sessile, with three broadly imbricate green sepals, about as broad as long, and three ovate petals. At the time the flower is receptive the petals are creamy white and about 1/3 longer than the sepals. There are six minute flattened staminodes whose bases are joined together and encircle the base of the ovary. The ovary is surmounted by a thick trifid stigma which is situtated immediately below the small opening formed at the tip of the flower by the petals.

Both the male and female flowers are very fragrant.

Male and Female Flowering Phases. The male and female flowering phases are different. The male flowers commence to open at the tip of each slender male branch and continue backwards towards its base in a fairly regular manner until all the flowers are exhausted. This phase lasts from three to four weeks. Near the end of the male phase the green petals of the larger female flowers commence to lengthen and change their colour. After the last male flowers have opened, the petals of the female flowers open slightly at the top and soon after the flowers become receptive and remain so far perhaps two or three days. Although the female phase definitely starts after the close of the male phase, the commencement of it, reckoning from the time of the opening of the flowers, has been found to vary considerably in different trees. In some instances the female flowers opened the day following the close of the male phase, whilse in others up to eleven days elapsed before they opened. The average time however was about four days.

The male flowers are visited by bees and other insects but no insect visitors have been seen on the female flowers. It would appear that pollen is carried by wind and so, are normally cross-pollinated. Only under exceptional circumstances can the flowers be pollinated by pollen from the same tree. This is an important point to show the difficulty in obtaining pure races of betel-nut under ordinary conditions. It has however been observed that young trees when growing rapidly under good conditions some times develop spadices in such quick succession that the male phase of the last opened spadix overlaps the female phase of the one immediately below, so that self-pollination is possible.

The fruit takes about eight months to ripen and when ripe is orange yellow or yellow in coulour and consists of a thick fibrous outer layer, the pericarp, which encloses the single seed or nut. The hard endosperm which fills the seed is traversed by the dark wavy lines which give it a marbled appearance resembling the nut-meg. The red or reddish brown markings are due to the infolding of a dark inner layer of the seed coat into the light coloured endosperm. The embryo, situated at the base of the seed is fairly large and conical in shape. The size and shape of the fruits and nuts vary widely according to types.

Varieties. As in other cultivated plants, the betel nut palm has different types according mainly to the shape of nuts. A number of types is seen mixed in a plantation and it can be said that no plantation is of pure type. In South India we find two main types. (i) "*Siya Adike*" — *A. Catechu* — *Var. deliciosa* — not fibrous, less

tannin and smaller. (2) " *Rama Adike* " — *Actinorhytis Calapparia* — much bigger nuts, more tannin but not useful as the fresh nut is said to act as poison (5) The main type grown is the former. As betel nut palm is normally cross-pollinated and as there are numerous types in each plantation, it is difficult to decide which of these are pure types of varieties unless regular breeding experiments are conducted. The types noted in Southern India are Round Big, Round Small, Convex Shaped, Pointed Top, Narrow Base etc., according to the shape of the fruits. In Malaya Peninsula there is said to be a variety with fruits 3½ inches in length and 2¼ inches in diameter thickness — round and long fruit.

Production Practices. Areca palm is confined almost entirely to the moist tropical tracts that fringe the coast line and it is seldom found more than 200 miles away from the coast. It is often seen in moderate elevations on mountains as on the slope of the Western ghats. It flourishes well in hot, moist, rich alluvial soil and in well-drained, rich peaty soils on the slopes of hills. The main point is that it requires a rich soil which retains moisture in summer and is well drained to drain off excess water in the rainy season. " A suitable piece of land is one which lies in a valley in the malnad and under a tank or in a fertile area in the fields of the maidan tract " (5).

Seed Selection. At present seeds for planting are selected by observing the following points :

(i) Strong and vigorous trees which are 30 to 40 years old or even older are chosen as seed parents.

(ii) The embryo of the nut must be small and exactly in the centre of the nut.

(iii) The nut should be medium with a fairly large quantity of tannin.

(iv) The shell must be thin, apex pointed and the bunch large.

(v) Nuts are selected from bunches that mature in November. (5)

It is also said by experienced ryots that oval round nuts should be selected from old trees which are regular good bearers.

Nursery. The seed nuts are gathered when fully ripe, dried for a day or two and then planted in well-manured, raised beds close to one another. It takes about 1½ months for the nuts to germinate. After three months from planting they are transplanted in well-manured nurseries 1′ x 1′ or 1′ x 1½′ according to the time they are to be kept in the nursery.

Planting. Pits (2 feet cube) are generally dug in summer 8' x 8' or 8' x 10' apart and left for weathering for about a month. Well rotten cattle manure and green leaves are put into the pits and covered up. Drains, bunds and irrigation channels are all made to suit the particular plot of land. Plants, 1½ to 3 years old as required, are planted in August—September.

After Cultivation. The plantations are given a yearly digging in August. Cattle manure and green leaves are applied liberally to individual trees, and drains and bunds repaired regularly.

Irrigation. It is a regular practice to irrigate the crop in most of the areas of South Kanara and in Mettupalayam but the palm is grown without irrigation throughout Malabar. This is one of the reasons for the poor yield in Malabar compared with that in South Kanara. Where irrigated, regular irrigations are given once in 15 days throughout the life of the plantation.

Yields. The harvest of the nut is done by climbers who are experts in climbing these palms and jumping from tree to tree. Yield of nut varies according to the region, the nature of the nuts harvested, the curing practices adopted etc., It ranges from 5 cwts. to 20 cwts. per acre, the average for South Kanara 2½ candies or 1400 lbs. of air dry nuts. The trees flower in about 6 years and normal yields are gathered from 8th to 10th year. The economical life of a tree is considered to be 40 years in South India. The tree is however said to live up to 75 years.

The flowering starts in January and the harvest begins in July–August and continues upto January. In the Malnad area of Mysore each tree gives two to three bunches on an average i. e., 800 to 1000, bunches per acre. Each bunch carries 200 to 250 nuts and so the total number of nuts will be 1,50,000 or 2,00,000 per acre. About 7,000 green nuts go to make one maund (28 lbs.) of the prepared product. Thus the yield per acre is 20 to 28 maunds (560 lbs. to 784 lbs.) of cured nuts. In South Kanara three to four bunches can be taken as the average giving 240,000 to 3,20,000 nuts per acre, the cured product being 1,200 to 2,240 lbs. per acre, as here the curing is of ripe nuts. Good yields are obtained in Mettupalayam where 3,50,000 nuts are obtained to give 1,000 lbs. of cured nuts (tender nuts cured). Milsum (1926) states "The mean yield of air dry nuts is 5·4 lbs. per palm in Malaya in an experimental farm at Serdang, the yield varying from 2·5 lbs. to 8·7 lbs. whereas on hill

quartzite soil the yield of 1·5 lbs. per palm is the highest obtained (10 year old palms.) The average weight of a fresh fruit varies from 30 gms. to 78·5 gms. while the weight of the air dry nuts varies from 5·1 gms. to 14·6 gms. This shows the wide variations in the size of the nuts and the proportion of the pericarp. The yield of the fresh fruits is from 19 lbs. to 49 lbs. per tree, the percentage of air dry nuts being 13 to 24 % the average of fresh nuts being 32 lbs. and the average percentage of dry nuts being 17 %.

The heights of trees of all the types or varieties were measured 10 years after planting. Average height of the palms is 30 feet from ground level to the base of the petioles and a further 10 feet to the apex of the young leaves. Thus the average growth increase in these palms has been 4 feet per annum (6)

Inter crops and Mixed crops. It is usual to see other crops grown in areca gardens in Mysore and South Kanara where bananas are planted practically during the first year itself, in the alleys of the areca palm. About 400 suckers go per acre. In Mettupalayam banana is planted about 6 months earlier than the actual planting of the areca 8 feet apart and they are completely removed after 2 to 3 years and the areca garden is thereafter kept pure and clean When banana is grown, a fair return is got from this crop, but the first bearing of the areca palm is delayed even up to 10 years, as the palms tend to grow slender and tall due to the shade of the banana crop. Even in old plantations in South Kanara banana is grown continuously as an inter crop. Pepper, betel vine and cardamom are also grown mixed in areca gardens. It is usual to grow coconuts, jack and bread fruit on the boundaries of areca gardens to provide wind breaks and shade to the garden as well as to give a further income from the yield of these trees. The economics of growing these crops as against a pure crop of arecanut is yet to be worked out.

Inter planting of arecanut in existing gardens or orchards is a common practice. As the trees die in areca groves, young seedlings are planted to fill up the gaps, and thus gardens of hundreds of years old are found in South Kanara with trees of different ages in the same plantation.

Curing. One of the main items of work in the cultivation of arecanut is the curing of the nuts for the market. It is either done by the merchants as in Mettupalayam and Malabar or by the cultivators themselves as in South Kanara. The process of curing

depends on the market to which the nut is to be exported. In Northern India, ripe, sun dried nuts are required, whereas tender processed nuts are preferred in the South. In South Kanara ripe nuts preserved in water are also largely used. There is no definite grade or standard for the cured procuct; the same kind of product is called by different names in different localities. The main methods of curing in some of the localities in the South are given below:—

Mettupalayam. Green nuts about a month before they are fully ripe are shelled whole by knife. The very ripe and too tender nuts are separated. The nuts are then cut into two halves cross-wise (harder nuts cut into four bits length wise) and boiled just covered with hot water. When the water just begins to boil which takes about 15 minutes the nuts are removed and immediately dried in the sun for a day. They are then coloured with a mixture of 1/4 part of syrup of decoction of areca and one part of one day's decoction, and dried again in the sun for three days. This product is called '*Kalipaku*'.

"*Dottepaku*" are the hard nuts cut into four pieces and cured as above.

"*Kurune*" are the tender whole nuts boiled, scooped out, dried, and treated with decoction as above and dried again.

The decoction is boiled for three days till a syrupy consistency is got and this is tinned and sold for preparing dyes and for use in tanning.

Malabar. At least 12 different varieties of cured nuts are known in this district:

1. *Aylam.* Tender nuts are husked, sliced and dried but not boiled. Under this there are the following according to the size of the nuts:
   (i) *Mullanki viravu* (ii) *Viruvu* (iii) *Mankapodi* (iv) *Ammanakri* (v) *Chitianam* (vi) *Poochittanam*.
2. *Nayam.* Nuts which are sliced thin and dried but not boiled.

The following are the sliced and boiled varieties:

3. *Levangacheer.* Cut into four longitudional splits.
4. *Nukkalcheer* Do. six do.

5. *Edua Cheer.*	Cut into more than six longitudional splits.
6. *Podichoor.*	Cut into finer bits.
7. *Mudichoor.*	Cut into finest possible bits (not generally made but to order).
8. *Ottavettu*	Cut into cross wise once. If the nuts are long, the central bit is taken out and only the two ends are left.
9. *Kuttnpude.*	Central bits of the long nuts.
10. *Alaku.*	Is No. 9 treated twice with "*Kali*" (Syrup or the boiled decoction).
11. *Krassl.*	Thinnest boiled nuts — one nut cut across into 80 slices.

South Kanara. The nuts are allowed to ripen fully on the tree. When fully mature and yellow, they are dried contionously in the sun till the nuts rattle inside the shell. They are then shelled and marketed as such without any definite grading.

Diseases and pests. "*Koleroga*" or "*Mahali*" caused by *Phytophthora Parasitica — var. arecae* — is the important one. It is found tc cause considerable damage in heavy rainfall tracts as in bad attacks the whole crop is seen to shed in the tender stages. *Control:* In North Kanara "*Kotte*" tying by means of small cover made of areca leafsheath or hillgrass dipped in Bordeaux mixture is being adopted to protect the bunches from rain and thus prevent attack of the fungus. It is not found as effective as spraying with Bordeaux mixture. It is practically controlled by adopting sanitary measures by destroying all the affected parts and then spraying with 1% Bordeaux mixture once just before the South West Monsoon and again after 1½ to 2 months. A third spraying may be necessary if the rainfall is very heavy. Large areas are now being protected in South Kanara and Mysore by these regular sprayings. The arecanut gardens in Mettupalayam and some parts of Malabar are free from this disease,

2. "*Anaberoga*" causen by *Ganoderma lucidus.* This is found in Mysore but is not serious (5) It is a wilt which infects the roots, proceeds up to the stem and causes wilting. Brackets develp on the side after the trees die. The tree should be cut off. Incorporating sulphur round the surrounding trees at half a pound per tree is also advised. In order to avoid-soil borne infection brackets should not be allowed to develop on the dead tree.

3. The stem-bleeding disease is caused by *Thielaviopsis* or *Ceratostomella) Paradoxa*. The removal and burning of the affected part is advised. Shading from South West aspect of the sun may be advantageour.

4. Band disease is found in Bombay. Nothing is done to control this at present. It appears to be physiological.

5. A new root diseas is being seen in parts of the Travancore and Cochin. It is found to be highly contagious and work on its control is yet to be done. Attention to cultural operation coupled with manuring and liming are said to be desirable.

Cost of Cultivation. The following gives a rough idea of the cost of cultivation of arecanut in South Kanara District in 1946:—

Particulars.	*Malnad area.* Rs.	*Non-Malnad area.* Rs.
1. Cost of raising & upkeep of the areca plantation up to 5 years till the crop comes to flower.	1,030—0—0	880—0—0
2. Amount realised by sale proceeds of catch crops during the period	600—0—0	750—0—0
3. Net cost per acre for 5 years	430—0—0	130—0—0
4. Cost of land per acre	1,000—0—0	2,000—0—0
5. Total cost per acre	1,430—0—0	2,130—0—0

From the fifth to the eight year, the cost of cultivation will be met by the produce.

6. Cost of the upkeep of the garden per year after the 8th year ...	360—0—0	288—0—0
7. Interest on capital	85—0—0	127—0—0
Total cost ...	445—0—0	415—0—0
8. Estimated value of yield at 2½ candies in Malnad area and 3 candies in Non-Malnad area at Rs. 400/- per candy of 560 lbs.	1,000—0—0	1,200—0—0
Net profit per acre	555—0—0	785—0—0

The price of nut at present is Rs. 520/- per candy and the net income therefore is much more. Further, an income of Rs. 100/- per acre is expected from other crops like banana, pepper, Jack etc., from the garden. The cost of cultivation varies with the localities and the nature of land.

Summary. The origin of the areca palm is not an agreed point. It is taken to be Malaya and the Philippine group of island.

2. The value of production of arecanut is more than 5½ crores of rupees in the Madras Presidency alone and thus it is an important commercial crop of South India.

3. The description of the plant and floral parts is recorded. It is a crop which is cross-pollinated and thus a number of different types is found mixed in the same locality. The main types are indicated.

4. An idea of the cultivation of the palm is given.

5. The curing methods and the names and grades of different cured products are found to vary widely. A brief description is given.

6. Different diseases on the palm are noted with their control measures. "*Mahali*" at present is found to be the most destructive.

7. The inter-crops grown are noted and the benefit or otherwise of the same is yet to be worked out.

8. A rongh idea of the cost of cultivation and the net profits per acre is given.

9. The importance of taking up the improvements of the crop immediately is brought out.

Conclusion. As there is not much precise data available on arecanut, this paper has been mostly compiled from figures and observations collected from various sources and through personal enquiries.

Betel nut industry is of considerable capable extension and it is estimated that 80% of the people of India are consumers of betel nuts. We are spending a large amount on the import of this product from outside. It is possible to increase both the area and the production of the existing gardens by careful scientific improvements and it is, therefore, necessary and urgent that this question is taken up immediately.

The following are the most important points to be considered in the improvement of the arecanut.

1. Selection of seed nuts: As already shown under the description of the palm, this being a cross pollinated crop, pure types are not found in any of the existing gardens. It is, therefore, necessary to evolve a definite programme of breeding work to select and breed the best and the promising types.

2. Till pure strains are evolved through breeding, a beginning has to be made to select the best gardens and mark out individual groups of trees for the purpose of distribution of seedlings of known merit.

3. There is no definite data available on the proper cultivation, manuring etc., of the crop. It is, therefore, necessary to record in detail the local practices and thus evolve a standard method till research on this point is carried out.

4. Regular and definite control measures against diseases should be done to control and eradicate diseases.

5. The best intercrops to be grown, the period up to which they are economic and beneficial, should be found out by investigation.

6. It is seen at present that rows of trees facing the southern sun are generally affected and sun-burnt, the stems af these trees becoming burnt and hollow on one side. Investigations should be directed towards finding out the best shade trees (no tree is found to grow as quickly as *Areca catechu* except perhaps *Casuarina,* which requires a sandy light soil) or whether a thick belt planting of areca itself on the southern side will protect the garden from sun-burn.

7. The curing of the nut is an important aspect where standard methods are yet to be evolved. More careful preparation of the product to suit the markets would still further enhance the market prices. Small machinery to dehusk the nuts will have to be devised.

8. Grading and marketing of the product should be improved and regularised. It is seen at present that a large margin of the profits is taken away by the middlemen and it is time that regulated markets are established for the sale of arecanuts.

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The Role of the Meteorologist in a Scheme of Grow More Food Crops

By

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The meteorologist has an important role in crop production where success depends upon a knowlenge of the weather conditions. This is particularly so in controlling pests and diseases. The Entomologist will work out the detailed life histories of particular insects in relation to the manner of damage and method of control. The Mycologist again may be ready with a prescription for the control of fungi. But it has been brought to light from recent investigations that the periodicity and virulence of pests and diseases are intimately connected with the prevailing weather conditions. Thus the meteorologist will be of immense help to these scientists with the forecast of weather conditions in advance to forearm them with suitable methods of control.

India is not wanting in intelligent farmers. In fact in every language there are sayings connecting the influence of weather conditions with the performance of cultivated crops. A thorough collection of all of the local 'folk lore' connected with weather and careful analysis of the same will certainly give one an insight into the influence of weather on crop growth. If the ideas behind them are scientifically scrutinised and interpreted, it should be possible to guide, with confidence, the agricultural operations in any particular locality.

Crop growth is a matter of applied physiology under the influence of the reaction of the crop to its meteorological environment. The extent of the reaction depends on the stage of development of the plant and the intensity of the major meteorological factors. Rainfall affects the crop directly and also indirectly by altering the surrounding temperature and the atmospheric humidity. The limit to which the changes in the temperature and the atmospheric humidity affect the crop depends on the length for which these factors are in operation. With the help of the thermographs and hygrographs or combined thermohygrographs one can get an idea of the periodic changes in temperature and humidity for working out their influence on cultivated crops from the records carefully maintained for the purpose.

If the data collected over a series of years regarding the microclimatic observations and crop observations are collated and interpreted, they will provide us useful and valuable information for our guidance.

There may be some indications of periodicity which may be helpful in reviewing agricultural practices and operations and in adjusting them to weather conditions. The sunspot is a case in point. It has also been found in many countries that there is a periodicity in the weather especially rainfall at a certain locality. Another interesting thing is the prediction of weather at a particular locality judging from the weather conditions that prevail in certain other localities. Thus it has been found that the onset of the South West Monsoon and the incidence of precipitation are governed by such trivial and remote factors as the South Rhodesian rain and Java rain and the South American pressure.

It has been computed that there is a four to one chance that the total monsoon rainfall of June to September of 1948 will be between 82 per cent and 112 percent of the normal in the Peninsula, between 79 per cent and 128 per cent of the normal in North West India and between 90 per cent and 110 per cent of the normal in North East India.

Another interesting study is Phenology, which is the science of relations between climate and periodic biological phenomena as the migratons and breeding of birds, the flowering and fruiting of plants etc. When sea birds fly out early and far to seaward, moderate wind and fair weather may be expected. When they hang about the land or over it, sometimes flying inland, strong wind with a stormy weather may be anticipated. As many creatures besides birds are affected by the approach of rain or wind, such indications should not be slighted by an observer, who wishes to forsee weather. For example, dragon-fly flying low, winged ants seen in large numbers, birds taking shelter in a hurried manner are some of the indications of impending rain. Particularly a knowledge of the amount and periodicity of rainfall is essential for preparing the soil and for ensuring good and even germination of seed in the first instance and subsequently in terms of evaporation and soil water relationships as controlled by atmospheric conditions, for favouring crop growth.

The importance of history of previous occurrence of drought or deluge in a particular locality is not to be belittled. There may be a law or rule governing such an occurrence. Statistical analysis of the existing data may throw some light on that law or rule in terms of past occurrences and their frequencies. The probabilities of the future occurrences and coincidence limits may even be worked out when sufficient data are available. The occurrences of floods in Bengal and Bihar can be taken as a typical example.

Liability of India to floods, droughts and storms. A careful scrutiny of the past records will give very reliable information on the parts of the country that have been now and then subject to famine due to the failure of the rains. Occasionally even the whole country is involved in famine.

Walford has recorded 34 famines in India during the 100 years ending 1879. The years 1877, 1899 and 1918 will ever abide in our memory as disastrous famine years, mainly due to the failure of the monsoon rains.

As contrast years 1878, 1892 and 1917 are to be remembered as the years in which floods or excessive rainfall occured over a large part of the country. South Indians will remember the famous floods of the year 1924 as they will have always in mind the current year 1947–48 as the year of failure of both the monsoons.

The examination and collation of data collected over a series of years will give one very useful information on (i) whether on a scientific basis any periods or regions can be marked off in our agricultural year and country; (ii) the quantity and distribution of rainfall which may determine the success or failure of a crop in a given region; (iii) the percentage of deficiency in the normal rainfall that may be regarded as the minimum limit for a given crop in a given locality and (iv) the atmospheric conditions in relation to pests and diseases of plants.

The main role which the meteorologist will have to play will be to post the farmers with reliable knowledge of the nature and quantity of rainfall which they can expect to have at stated intervals. This takes us on to the question of forecasting of weather and organisation of weather services. A beginning has already been made by the Indian Meteorological Department for an all India interest and now and then for provincial interest also. But we have to develop this branch so that we may be able to forecast for a larger section of the people by opening a net work of observatories and thereby making a very thorough study of the elements of weather. The farmers are really interested in knowing whether, weather conditions will be such as will enable them to do timely agricultural operations and to produce a good crop during the coming season. Admittedly, in Madras Province we have not yet attained that stage as to be of some service to the farmers in this connection. It is for this lack of sufficiant information and warnings of weather that the farmers here often consult Indian almanacs which predict in some way rainfall in the light of the astronomical calculations on the position of stars and planets in relation to the Sun and the Moon. A close contact with any actual tiller of the soil will reveal two facts, namely, (i) the hopes and fears regarding the rainfall in which the majority of the farmers live and (ii) the importance which the older and experienced farmers attach to rainfall in a particular "Karthi" ... a term related to the position of constellations in the Zodiac–as a means of predicting weather and rainfall. Some of the beliefs are no doubt based on ages of experience but the majority are only popular beliefs. The local almanacs, which have a reputation in the villages, are based on the science of astronomy. Dr. S. N. Sen of the Indian Meteorological Department in his publication in Science and Culture 1937, on "Meteorologicai Interpretation of

Kalidasa's 'Megha Duta' or cloud messenger, has stated that the knowledge of cloud movements and rain two thousand years ago is surprisingly similar to modern knowledge. It would, therefore, appear that ancient weather lore is not all trifle and that there is something in it that is worthy of scientific investigation and that too before the learned astronomers who prepare almanacs become extinct. The first thing to to be done is to ascertain whether and how far there is any agreement between the predictions ef rainfall made in the almanacs and the rainfall as recorded by the raingauges in the previous years. Such an investigation is bound to be useful. If one takes up this investigation, he will find that it offers a rich field for study of the actual weather conditions over long periods. From this point of view also collection of accurate weather data over long periods is very essential.

Conclusion. It is hoped that meteorology, which is nothing but applied physics, will very soon play as important a role as some of the applied sciences such as Agricultural Botany, Agricultural Chemistry etc. in a scheme of grow more food production. It is unfortunate that the branch of Agricultural Meteorology has been neglected so far particularly in the Madras Province. A beginning has however been made by the creation of a separate section of Agricultural Meteorology in the Agricultural Department. It is hoped that with the kind patronage of the Madras Government and able guidance of the Indian Meteorological Department, Poona, this newly created section will be able to help the farmer by codifying the weather data and issuing such warnings as are possible.

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Romance of the Reborn Sugar Industry in India

By

Dr. T. S. VENKATARAMAN

[*A summary of the popular lecture which was delivered at Walchandnagar, (District Poona) on 10th February, 1949 at 6-30 p. m., during the occasion of the Eleventh Meeting of the Indian Central Sugarcane Committee*]

Though it is widely known that the Benares Hindu University owes its origin to our revered leader, Pandit Madan Mohan Malvyaji, it is within the knowledge of only a few that the rebirth of the Indian Sugar Industry was also initiated by Panditji. It was he that drew the attention of the Government of India to the deteriorating position of the home industry caused by imports of cheap white sugar from Java. At the instance of the legislature, the Central Agricultural Board initiated work in two directions. One was on the manufacturing side and consisted of trying to evolve a unit in between the modern sugar factory and *gur* manufacturing methods. To the Station at Coimbatore was entrusted the task of producing improved sugarcanes for the country. This is because the canes in cultivation over the bulk of India were easily some of the poorest in the world.

In view of the fact that canes imported from other countries were mostly failures, the station at Coimbatore attempted to produce new canes within the country by suitable breeding. At that time the opinion was strongly held both in India and outside that sugarcanes did not produce fertile seeds under Indian conditions. The first possibly sugarcane seedlings that germinated were too carefully grown and under such artificial conditions that most of them died out. An attempt was therefore made to germinate the seeds in the open and under natural conditions exposed to both the sun and rain of India. This resulted in quite a large number of germinations which gave the suspicion that they were all only grasses and not real sugarcane seedlings. The order was therefore given that they should be destroyed to prevent discredit to the attempt. Fortunately, however, a holiday intervened between the order and its execution. This enabled a reconsideration of the matter and it was decided to keep the seedlings for a couple of months but removed from public view. If ordinary grasses they would show themselves up by the time. The wells in Coimbatore are very deep and the seedlings found a lodging in the berm of these wells hidden from public view. These plants which later proved to be genuine sugarcane seedlings were thus born and grew under some form of imprisonment. This reminds one of the manner in which great men were ushered into this world. Lord Jesus was born in a manger and Lord Krishna in prison.

When the Indian Sugar Committee of 1920 visited our then chief source of white sugar namely, Java, both information and plant material were freely given to India as it was thought at the time that India could never count in the white sugar world. It was then more than half a dozen years since the Coimbatore station was started on a temporary basis and so its productions were beginning to show some promise in the experimental plots of certain provincial stations. Even so, the Committee which contained men of knowledge and experience made bold to recommend the continuance of the Coimbatore attempt.

The productions from Coimbatore had many vicissitudes during their infancy and childhood stages. Being on a temporary basis the retrenchment committee constituted at the time by Government to effect economies naturally paid its first attention to Coimbatore. Fortunately however, the canes from Coimbatore — though yet grown only in small plots — had attracted the attention of a group of sugar factories in Northern India and under European management. This was because of the enthusiasm of the Sugar Bureau under Mr. Wynne Sayer who was able to get grants from the factories for expanding this work. As hard headed businessmen had placed belief in the possibilities of the Coimbatore attempt it was easy for the Government of India to continue the station though for short period and on temporary basis.

At that time certain of the Scientists at Pusa developed a hostile attitude to the Coimbatore productions. The now famous Sir Albert Howard opined that the flowering of the Coimbatore canes showed weakness. He also mentioned that the higher yields would quickly impoverish our soils. Mr. G. Clarke who was in charge of the most important sugarcane station in the U. P. pinned his faith in the Java canes which he had imported and was pushing into the cane belt. He felt that Coimbatore could not come up to the level of the Java work and therefore practically banned the cultivation of Coimbatore cane near his station. Perhaps, the first favourable report of Coimbatore work came from distant Cuba who found Co. 281 a useful cane. The factory at Nellikuppam in South India came to know of this and obtained planting material of this cane from Coimbatore.

Apart from the above there existed a popular prejudice against these productions because they were new. Some North Indian cultivators thought that because of their flowering the Coimbatore canes would ultimately develop weakness. It was even believed at the time that *gur* from Coimbatore canes would cause impotency.

Amidst these gloomy environments credit is due to the first Tariff Board which definitely realised that there was some possibility in India to develop a strong home industry. It has to be remembered that at that time, the Coimbatore productions were practically confined to experimental

plots in Government farms. The Coimbatore canes soon spread into cultivation and easily established their superiority in the grower's fields. Planting material of certain of these canes were even stolen from experimental stations and one such cane—rejected by the Experiment Station at the time—served the industry in a remarkable way for some time. This shows that when an improvement is real it does not take much labour to put it across to the Indian Cultivator. The Deitz Lanterns now so popular in India won their way through sheer superiority.

The Coimbatore productions soon came to be known in the other sugarcane stations of the world and indents began to pour in from other sugar stations on the basis of exchange of material. To-day, the Coimbatore productions have shown their use in many parts of the world from Cuba and Peru in the West to Australia in the East. In fact, the Coimbatore work came to be known in the other parts of the world earlier than most other achievements of the Agricultural departments in the country.

If one were to examine the basic factors on which the Coimbatore work was built up these may be summarised in three words:—SINCERETY, BOLDNESS and HIGH ENDEAVOUR. From the very commencement the persons in charge of Coimbatore work concentrated their sole attention on only one object namely, the production of improved canes for India. Secondary issues of however great scientific interests were religiously eschewed to conserve the energies of the station for the main work set before it. This aspect is very important for real advance in research with a definite aim. Unfortunately, this is not always realised in the country. Again, the Coimbatore scientists pursued in their endeavour new and bold lines in their scheme of hybridization. The programmes followed were frowned upon by orthodox text book scientists. Today the Coimbatore sugarcane station has got a range of parent material comparable to and in some cases superior to the other sugarcane stations of the world. For success in the future the station needs a personnel with high enthusiasm and boldness to follow up the new and novel lines of hybridization laid down during the past three decades of its existence and freedom to carry on its work unhampered by official red tape and all it connotes. JAI HIND.

Mechanization of Agriculture

*(*Summary of Some Papers contributed to the Agricultural Economic Conference, Hyderabad, Deecmber 1948).*

Dr. V. V. Sayyanna (School of Economics and Sociology, Bombay) read a paper, showing the progress of machanization in agriculture in countries abroad, in most cases up to 1940. In the wheat belt of U. S. A. almost every farm had one tractor at least, and there were more than one in many cases. The value of the mechanical equipment increased by 2½ times between 1910 and 1930, when it was estimated at 3.300 million dollars. Under the Rural Electrification Adminstration electrical service on co-operative lines expanded in rural areas in the U. S. A. When the R. E. A. was established in 1935 only 10 percent of farms were electrically equipped. There were in 1940 June 617 co-operatives sponsored by R. E. A. It was proved that electricity could be supplied at reasonable rates in rural areas for running agricultural machinery as well as for domestic lighting and other amenities.

The U. S. S. R. had adopted machinery in her collective farms, for ploughing, sowing, threshing and harvesting on an unprecedented scale. They were supplied and repaired at the State machine tractor stations. In the prewar year 23 million hectares were ploughed, 56 million hectatares were sown and 45 million hectares were harvested by machinery.

Mechanization appears best suited to large farms, but of late there has been a movement for extending such benefits to small and medium sized farms. Manufacturers are turning out machines suited to the technical and economic needs of small holdings. Researches are directed to the construction of multi purpose tractors at moderate prices which can cater to several requirements of farmers. Co-operatives are being established among small farmers for purchase and use of machinery in common. Just before the war there were 30,000 general agricultural co-operatives doing this service in Europe. Besides there were a number of special societies formed for the purpose in Scandinavian and Baltic countries. The State subsidised the manufacturers and users of small machines.

In India so far mechanised cultivation has been attempted only by a few land owners in Gujarat, Karnatak, Central Provinces, North Bihar and Orissa. There was no planned or definite effort by individuals, private bodies or Government, to encourage the use of machinery. The attempt to use machinery on large scale is the by product of 'Grow More Food Campaign'. In 1948, 300 tractors were received from abroad and 200 more were expected from U. S. A. and U. K.

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* By Mr. K. C. Ramakrishnan, who attended the Conference.

Besides, the Government of India had obtained from the U. S. surplus stores, 300 trotors, most of which have been distributed to scarcity provinces and states. In the United Provinces 45,000 acres of waste land were reclaimed. The Central Provinces Government have planned to clear 100,000 acres of *kans* infested land to bring it under wheat. The Government have decided to open a few tractor stations and make tractors available for ploughing fields at Rs. 20 per acre. In the East Punjab, large scale machanical cultivation is being encouraged for rehabilitation of refugees from West Punjab.

The Ministry of Food and Agriculture of the Government of India have drawn up a six year plan of land reclamation with the help of the tractors now in hand and by importing 1000 tractors during the next three years. Nearly six million acres of cultivable waste land can be brought under cultivation, which may add only about 2 million tons of food grains annually to India's food resources. Still there will be a shortage of one million tons to the target of 3 million tons set up by the Food Grains Policy Committee. In order to reach this figure, approximately 10 million acres of cultivable land will have to be reclaimed. Here is a rough estimate of the areas available.

Assam ...	4 million acres.	Malva Union ...	1 million acres.
Orissa ...	1 " "	Vindhya Union	500,000 acres.
Madras Agency	1 " "	East Punjab	500,000 "
United Provinces	1 " "	Berar ...	200,000 "

Mr. R. S. Basrur Mechanical Cultivation Engineer to the Government of Bombay, contributed a short note on the achievement of his section up to the end of October 1948.

Deep Ploughing ...	26,000 acres.	Terracing ...	200,000 feet.
Shallow Ploughing ...	76,000 "	Grading ...	1,500 hrs.
Harrowing ...	6,000 "	Bunding ...	100 "

Deep ploughing work is undertaken for eradication of weeds and reclamation of waste lands. Shallow ploughing was undertaken only when deep ploughing work was not available.

In his opinion, success of mechanization depends on (1) concentration of work, (2) maximum period of tractor operation in an area in a season and (3) minimum wastage on movements. Deep ploughing work in some areas in Karnatak and Khandesh almost gives these ideal conditions. In Karnatak tractors are employed from October to April on weed eradication work; and from May to mid-June on seasonal ploughing. Larger holdings give better ploughing results with the tractor. This type of work should be enforced by law on cultivators who have *hariali* infested areas.

Employment of tractors only on seasonal ploughing in areas entirely reliant on monsoon is not an economic proposition. The ploughing season in such areas is short, and the requirements of cultivation cannot be fulfilled unless a very large fleet is maintained in that area, which would be idle for a major part of the year and result in heavy overhead expenses. This can be minimised to some extent, if units of 200 tractors are handled by a large number of co-operative societies in the area. These tractor units, with power attachments, can be employed for pumping thrashing and transport purposes during slack season. Tractors on unirrigated tracts can be employed on seasonal ploughing practically throughout the year in areas like Belapur, Kopergaon can be undertaken as a succesful commercial enterprise.

In districts which have small holdings and very short ploughing season, it is not economic to run tractors. Mechanical cultivation has a bright future in about 10 districts of Bombay. Tractor units should be mobile and operate according to the demand of the public. The size of a unit should be 6 to 8 tractors and each should be self-sufficient for repair, maintenance etc. Government tractors should be employed in the reclamation and eradication of weeds only. Seasonal ploughing should be entrusted to private bodies and individuals, who may be encouraged by the provision of timely technical assistance, supply of spare parts, oils and lubricants. Owners should be given some technical training, so as not to rely too much on unscrupulous drivers.

On the question of a large number of light tractors or a small number of heavy tractors, the former is preferred on the score that in the event of a casualty, percentage of efficiency of the whole unit is not affected markedly and capital cost is much less. As against this, overhead charges, compared with heavier tractors for the same capacity, are heavy. Much depends on the agronomical features of the areas, e. g. it is advisable to use lighter tractors in Konkan districts, where individual holdings are small. Heavier tractors do better in an area of large holdings.

Mr. M. C. Dutt, Agricultural Engineer, Assam, had a brief note.

Reclamation of waste lands. Assam provides enormous scope for extension of cultivation on virgin lands. People are too poor to buy machinery and implements. The Government of Assam has chalked out plans to help the cultivators, organised in co-operative societies, by supplying them with tractors and implements at scheduled rates for ploughing and harrowing the lands. The Government has decided to establish a central workshop and two mobile workshops with all facilities for repairs and maintenance and advice.

Heavy tractors are used in reclamation of land with medium depth of ploughing so as to protect the land from heavy soil erosion. Bull-dozers are proposed to be employed to clear light forests, and graders on highly undulated lands. It is also proposed to put in contour bunds for safeguarding against erosion.

Mechanical cultivation of arable land. Shortage of labour has rendered cost of cultivation very heavy. Uneven rainfall leads to untimely operation in agriculture and subsequent damage to crops and poor out-turn. The soil gets hardened up which the country plough cannot tackle. The need to employ machinary for breaking up the soil quickly has been felt.

The Department of Agriculture has in the period of 6 months opened up 3 projects in the Province. The task of organisation and operation has been difficult, as the spirit of co-operation has still to be infused among farmers. Up to the end of October, only 27,000 acres have been cultivated. Operations are proceeding in other areas and about 5,000 acres more will be added in the course of the year 1948.

Mr. V. Subbarajan, Engineer, Hyderabad (Deccan) stated :—

The items that have to be taken into account for examining the economic aspect of mechanization are :—

1. Interest and depreciation.
2. Running expenses,
3. Cost of repair and service.
4, Miscellaneous charges such as transport etc.

As mechanization should be adopted only for certain agricultural operations, the comparison of costs will be limited to the following.

Tractor and bullock or manual power for land development and also for annual ploughing on large estates.

Tractor power versus bullock or manual labour.

The useful life of a tractor under field conditions may be taken at 10,000 hours of five years with 2,000 hours of working per year. On this basis the rate of depreciation will be 20 percent. The interest on capital outlay may be taken at 4 percent. Considering a 10 H. P. tractor attached with necessary ploughing equipment the cost of work will be as follows. The cost of the tractor with plough outfit will be about Rs. 35,000.

1. Interest and Depreciation per hour at 4 per cent and 20 per cent per year of 2,000 hours respectively on Rs. 35,000. Rs. 4—3—3

2.	Running expenses per hour: 5 gallons of H. S. Diesel Oil at Rs. 1—8—0 per gallon.	Rs. 7—8—0	
	1 gallon of lubricant	3—8—0	
	Grease 2 Lbs.	2—0—0	
	Cotton waste	0—1—0	
			13—8—0
3.	Cost of repair and service per hour		2—0—0
4.	Labour and supervision charges per hour: Driver	0—8—0	
	Cleaner	0—2—0	
	Supervisory and service staff	0—8—0	
			1—2—0
5.	Miscellaneous expenses per hour		1—0—0
		Total cost per hour	21—13—3

A tractor of this type can plough ¾th of an acre in one hour in hard clay soils to a depth of 12″ to 14″. The cost per acre works out at Rs. 29—1—8, or say Rs. 29. The cost per horse-power hour works out to Rs. 0—3—6. If the same work has to be done by digging by manual power, the cost will be as follows :—

The total excavation on one acre to a depth of one foot will be 43,560 cubic feet and the cost of excavation at Rs. 0—8—0 per 100 cu. ft. will be Rs. 217——8—0 as against Rs. 29 by tractor.

An average person is expected to develop 1/10th horse power. At Rs. 1—4—0 wages for one day of 8 hours working, the cost of horse-power by manual labour works out to Rs. 1—9—0 as against Rs. 0—3—6 by tractor. Thus it will be seen that work by tractor will cost only 1/7 of what it will cost if the work is done by manual labour. It may be noted that bullock power is of no use for deep ploughing in black cotton soils infested with weeds, where hand digging or tractor ploughing is the only solution. Similarly in developed areas the cost of ploughing by tractors can be compared with that by bullock power. A pair of bullocks is expected to develop one horse-power. For shallow ploughing in medium soils, 40 H. P. tractor is considered suitable. To do the same job as a tractor of 40 H.P., 40 pairs of bullocks are required. In the appendix details of cost comparison are given, from which it will be seen that for ploughing 6″ to 8″ in medium soils, it will cost Rs. 7—8—0 per acre by tractor and Rs. 11 per acre by bullock power. Thus farm work is definitely cheaper by tractor than by manual or bullock power.

The tractors can be utilised actively for a period of 8 months, from November to June. During the period when ploughing is not possible, the tractors could be utilized for stationary purposes. The tractors are extremely adoptable power units and power may be delivered at drawbar, at a belt pulley or at the special power take off. As a stationary engine, it can be utilized for pumping, crushing and similar jobs.

Appendix

Comparison of costs by Tractors and Bullock Power.

S. No. Particulars.	Ploughing by a H. P. tractor with Mould Board Plough.	Ploughing with 40 Pairs of bullocks equivalent to 40 H. P.
1. Capital outlay	Tractor and implements Rs. 25,000	at 400 each bullock Rs. 32,000
2. Depreciation per year	5 years life Rs. 5.000	10 year life Rs. 3,200
3. Interest	4% Rs. 1,000	4% Rs. 1,280
4. Running expenses	Cost per hour :— 2 gallons fuel oil Rs. 3-0-0 ½ gallon lubrication 1-12-0 1 lb grease 1-0-0 Cotton waste 0-8-0 Cost per hr. 6-4-0 per year of 2,000 hours of working Rs. 12,500	Fodder @ 40 per month per pair of bullocks and per year for 40 pairs Rs. 19,200
5. Repair	@ Re. 1/- per hour & for 2,000 hours of working in a year Rs. 2, 2,000	@ Rs. 10 per set of implements and 40 sets Rs. 400
6. Labour charges	Driver @ Rs. 90/- P. M, & cleaner at Rs. 30/- P. M. per year Rs. 1,440	30 men for 8 months 10 men 12 months at Rs. 25/- P. M. Rs. 9,000

S. No.	Particulars.	Ploughing by a H. P. tractor with Mould Board Plough.	Ploughing with 40 Pairs of bullocks equivalent to 40 H. P.
	Total operating costs per per year including interest and depreciation running expenses, repair and labour charges.	Rs. 21,940	Rs. 33,000
	Total anticipated output of work	at 1½ acres per hour & for at 2,000 hours of working in a year Rs. 3,000-acres.	Rs. 3,000
	Cost per acre	Rs. 7·31 or say Rs. 7–8–0 per acre.	Rs. 11.03 or say Rs. 11–0–0 per acre.
	Cost per horse power	Rs. 0–4–6.	Rs. 0–6–8

The Madras Agricultural Journal.

*

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Secretary,

THE MADRAS AGRICULTURAL STUDENTS' UNION.

HINTS TO FARMERS

Beware of soil erosion.

The failure of crops is often attributed to the impoverishment of land brought in by continuous cropping or by precarious rainfall. But many of the cultivators are still not aware of the fact that soil erosion also plays a very important role in stealing the soil of the plant food, moisture, etc. The perpetual drain on soil by erosion depletes the land gradually of its soil fertility. When the soil erosion is long and continuous, even the skeleton of the soil-body is not left over in the land. When such a stage is reached, the soil completely loses its capacity to produce crops. The exact loss by soil erosion is beyond estimation. However according to estimate made in United States of America. ***Erosion steals 21 times as much plantfood as the crops take out of the land!*** The soil erosion not only steals the plantfood but also changes the physical condition. With changes in the phisical condition, water holding capacity of the soil, under ground drainage and supply of under ground water also change. All these changes eventually bring down the crop yield and bring the soil to the starving condition.

When the soil in the field is lost by erosion, no amount of other improvements can really become effective. Improved farming which consists of the supply of improved crops, application of new fertilizers and manures and use of new implements cannot be much helpful if the soil is not retained permanently in its place and in sufficient depth.

Soil erosion is therefore one of the problems which seriously confronts the South Indian cultivator. He is not, as it appears at present, sufficiently conscious of the losses to the land and himself. By soil erosion millions of tons of soil are lost every year even with the average annual rainfall of 20–25 inches, rendering the land poorer and poorer. The agricultural wealth is thus drained unrestricted.

It is a wrong notion which many have that soil wash or erosion is restricted only to places of heavy rainfall or to hilly and forest areas. But soil erosion is also very common over flat and level lands where there are some small undulations and gentle slopes. When rains are received in storms and torrents, it has no time to soak into the soil even if the land is perfectly level and flat. Again a sharp intensive shower of less than an inch falling within a few moments, causes greater havoc than a soaking rain of several inches received in small drops over a long period.

The type of erosion which is generally met with in Southern India is field erosion which is very extensive and universal. This erosion should be prevented by adopting some of the following direct and indirect methods:—

(1) Terracing and constructing small bunds across slopes.

(2) Fallow cultivation of lands such as ploughing, harrowing and sowing crops along contour lines.

(3) Opening furrows and forming ridges across slopes by ridges and scoopers.

(4) Ploughing the sloping fields with a turnwrest-plough or the one-way-plough from the lower level to the higher level across the slopes.

(5) Povision of spill-ways joining common drains and construction of weirs and aprons to allow excess storm water proving harmful to the crops.

(6) Construction of small embankments and weirs across the nalas to break the force of water and to allow deposition of silt.

(7) Provision of small tanks and ponds spread all over the country for the collection of the silt-laden water and for the stimulation of underground springs which supply water to wells.

(8) Spreading crops like groundnut, horse-gram, lab-lab, cow-gram and dew-gram or a long duration crop like red-gram give resistance to the flowing sheet of water.

(9) Turfing bunds and edges with grasses and dry rivetting with stones, wherever necessary for protection.

(10) Application of silt and soil, cattle-manure, composts of organic matter ploughing in green manure crops and cultural operations tend to absorb and retain moisture thereby preventing soil erosion to some extent.

(11) Allotting a portion of the cultivated area for pasture with trees planted here and there can also control the run-off water and save soil erosion. Such pastures can be broken and crops cultivated in rotation.

The methods to be adopted and their cost depend much on the locality and individual cases. A joint scheme of terracing and bunding of fields in a village can be achieved by the co-operation of the cultivators. Similarly construction of weirs, aprons, dry rivetments, digging of common drains, cross-bunding of nalas, provision of tanks and ponds for trapping water and silt are possible only by co-operation.

The experiments conducted for the past 4 or 5 years in the dry farming of the Bellary black soil go to show that an average extra annual net income of Rs. 6 per acre can be got by bunding.

[Villagers' Calendar, Govt. of Madras]

Abstract.

The importance of studying the cytogenetic effect of the various insecticides and fungicides which are being used to protect crops against insect pests and diseases appears not to have been sufficiently recognised by cytogeneticists and plant breeders. Though the best insecticides and fungicides are those which kill the plant parasites without affecting the plant organism some of them have been found to affect the host plant in various ways and degrees. Thus for example ethyl mercuric chloride which is the active substance of the fungicide "Granosan" induces atypical growth, abnormal mitosis and polyploidy. Almost similar effects have been seen in the case of Hexachlorocyclohexane (666) which has of late found widespread use as an insecticide. Hexachlorane stimulates the germination of certain *cruciferae* initially, but the growth of such treated seedlings become strikingly suppressed later on.

Cytological studies of the roots of a number of plants treated with insecticides containing hexachlorocyclohexane have revealed that the agents cause disturbances in the mitotic processes by acting upon the cytoplasm and interfering with the cytoplasmic processes involved in the formation of achromatic bodies. The continuance of such disturbances leads to the production of tetraploid, octoploid, and even cells of much higher degree of polyploidy. Certain changes in the nuclear elements have also been induced by the active agents. The changes resemble those induced by colchicine, acenaphthene and other polyploidizing agents. Two features however are worth noticing; one is that the tissue is affected only if the particles are in contact with it unlike in the case of acenaphthene; the other is that meiotic processes are practically unaffected.

Insecticides and fungicides which induce disturbances of the sorts mentioned above, "when applied, may increase the hereditary changes in the cultivated "pure lines" leading thus to more rapid degeneration of the highly bred uniform varieties. This means that when one applies such insecticides or fungicides one should more frequently change the seeds of the varieties which he propagates, by using a fresh non-degenerated stock."

(Cytogenetic changes and atypical growth induced by Hexachlorocyclohexane C_6 H_6 Cl_6) by Dontcho Kostoff; *Current Science,* 17: 294–5).

Agricultural College and Research Institute Library, Lawley Road, Coimbatore.

MONTHLY LIST OF ADDITIONS FOR MARCH 1949

1. BELL (G. D. H.): Cultivated plants of the farm. 1948
2. DETURK (E. E.) Ed: Freedom from want, a survey of the possibilities of meeting the World food needs.
3. EMERSON: Basic Botany. 1947
4. FREAR (D. E.): *Comp:* Catalogue of insecticides and fungicides. 1943
5. HUTCHESON (T. B.): *etc:* Production of field crops; a text book of agronomy. 1948
6. HYLANDER (C. J): Plants and man. 1947
7. COSTING (H. J.): Study of plant communities an introduction to plant ecology. 1948
8. PATIL (P. K.): Food problems in general and in Kolhpur State in particular. 1948
9. TOTHILI (P. K.): *Ed:* Agriculture in the Sudan. 1948
10. UNWIN (J. D.): Our economic problems and their solution. 1948
11. VOGI (William): Road to survival. 1949
12. HUTYRA (Franz): Special pathology and therapeutics of the diseases of domestic animals edited by J. Russel Greig and J. R. Mohlor in 3 V. 1946
13. SOIL CONSERVATION—an international study by F. A. O. Agricultural Studies No. 4. 1948

Crop and Trade Reports

Statistics — Crop — Paddy 1948 — '49 — Third or Final Forecast Report

1. The average area under paddy in the Madras Province during the five years ending 1944—'45 represents 13·3 percent of the total area under paddy in India.

2. The area sown with paddy in 1948—'49 is estimated at 10 229,000 acres as against 10,352,000 acres estimated for the corresponding period of the previous year and the finally recorded area of 10,434,149 acres in 1947—'48 according to the season and crop report The present estimate shows a decrease of 1·2 percent as compared with the corresponding estimate of the previous year and of 2·0 percent as compared with the final area for the previous year.

3. When compared with the final area of last year, an increase in area is estimated in the districts of West Godavari, Krishna, Bellary, Nellore, Tanjore, Ramnad, Tirunelveli and Malabar. and a decrease in area in all the other districts of the Provinc except the Nilgiris, where the area is expected to be the same as that of last year. The decrease which is marked in the districts of Anantapur, Cuddapah, Chingleput, South Arcot, Chittoor, North Arcot and Salem, is due to late and inadequate receipt of rains during the sowing period and insufficient supplies of water in irrigation sources.

4. 1,326,000 acres have been reported as sown since 1st December 1948, made up of 229,000 acres in the Circars, 90,000 acres in the Deccan, 252,000 acres in the Carnatic, 280,000 acres in the Central Districts, 439,000 acres in the South and 36,000 acres in the West Coast and the Hills. The area sown since 1st December 1948 was higher than that sown in the corresponding period of the previous year by 337,000 acres or by 34·1 per cent.

The area under second crop paddy is expected to be below the normal in the Carnatic and the Central districts as a result of the failure of the North East Monsoon rains and the consequent inadequacy of supplies of water in irrigation sources. Ploughing of wet lands on a large scale for raising second crop has been delayed or suspended in parts of Chittoor and North Arcot districts. In the Malabar and South Kanara districts the area under second crop is reported to be above the normal due to favourable seasonal conditions.

5. The harvest of the main crop of paddy is in progress. The yield per acre is expected to be normal only in the South Kanara district, and below the normal in all the other districts of the Province, due partly to untimely heavy rains received at the time of flowering in the Circars districts, and partly to the failure of the North East Monsoon rains in the Carnatic, the Central districts and parts of the South and the damage caused by attacks of insect pests. As the result of the failure of seasonal rains and the consequent inadequacy of supplies of water in irrigation sources, the crops sown early in the season in the districts of Anantapur, Cuddapah, Chingleput, South Arcot, Chittoor, North Arcot and parts of Ramnad have been severely affected by drought. The crop also suffered damage due to attacks by insect pests which increased considerably during December 1948 and January 1949. Attacks by pests were reported in two taluks in Cuddapah district, four taluks in Chingleput district, parts of South Arcot district, three taluks in Chittoor· almost all taluks in North Arcot, seven taluks in Salem, four taluks in Coimbatore, all taluks in Tiruchirapalli and parts of the Tanjore, Madura and Nilgiris districts Failure of crops is reported to have occured on a fairly wide scale in the Chingleput and South Arcot districts, and to a lesser extent in parts of Kurnool, Anantapur, Cuddapah, Chittoor, North Arcot, Salem, Tiruchirapalli and Ramnad districts.

The seasonal factor for the Province as a whole works out to 81 per cent of the normal as against 82 per cent in the season and crop report of the previous year. On this basis the total yield is estimated at 4,208,000 tons of cleaned rice as against 4,330,000 tons of rice estimated in the season and crop report of the previous year, representing a decrease of 2·8 per cent.

6 The average wholesale price of paddy II sort, per imperial maund of 82 2/7 lbs. (equivalent to 3,200 tolas) as reported from important market centres on 19th February 1949 was Rs. 10—8—0 in Virudhunagar, Rs. 10—4—0 in Vizianagaram, Rs. 9—6—0 in Cuddalore, Rs. 9—4—0 in Kakinada and Mangalore, Rs. 9—2—0 in Mathurai Rs. 8—15—0 in Masulipatam, Rs. 8—13—0 in Guntur, Rs. 8—8—0 in Kumbakonam, Rs. 8—6—0 in in Vellore and Tiruchirapalli, Rs. 8—2—0 in Nagapatam and Rs. 8—1—0 in Eluru. when compared with the prices published in the previous report i. e., those which prevailed on 15th January 1949, these prices reveal a rise of approximately 17 per cent at Virudunagar and have remained stationary in the other centres.

Sub:— Statistics—Crop—Groundnut—1949—First Report.

The area sown with summer or irrigated groundnut during the three months (January to March—1949) is estimated at 53,200 acres. When compared with the estimated area 57,100 acres for the corresponding period of last year there is a decrease of 6·8 per cent due mainly to failure of rains.

The Wholesale price of groundnut (Shelled) per Imperial Maund of 82 2/7 lbs. (equivalent to 3,2000 tolas) as reported from important market centres on 9th April 1949 was Rs. 28—5—0 in Coimbatore, Rs. 26—8—0 in Nandyal, Rs. 26—5—0 in Hindupur, Rs. 26—3—0 in Cuddalore, Rs. 26—1—0 in Salem, Rs. 26—0—0 in Guntur Rs. 25—14—0 in Adoni, Rs. 25—9—0 in Tadapatri, Rs. 24—5—0 in Erode, and Rs. 23—8—0 in Cuddaah. When compared with the prices published in the previous report i. e. those which prevailed on 8—1—1949 these prices reveal an increase of 21 per cent in Hindupur 20 per cent in Cuddalore, 19 per cent in Nandyal, 18 per cent in Coimbatore, 15 per cent in Adoni and Tadpatri, 10 per cent in Salem, 7 per cent in Guntur, and 3 pei cent in Erode. (From Public and Economics Statistics Dept.)

Cotton Raw, in the Madras Province: The receipts of loose cotton at press on and spinning miles in the Madras Presidency from 1st February 1949 to 8—4—1949 amounted to 29,246 bales of 392 lb. lint as against an estimate of bales of the total crop of 1948—'49. The receipts in the corresponding period of the previous year were 68,041 bales. 102,585 bales mainly of pressed cotton were received at spinning mills and 1655 bales were exported by sea while 38,471 bales were imported by sea mainly from Karachi and Bombay. (From Director of Agriculture)

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Weather Review—For March 1949.

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	Nil	—0·6	Nil
	Calingapatam	Nil	—0·4	0·3
	Vizagapatam	Nil	—0·5	0·4
	Anakapalle*	Nil	—1·0	0·2
	Samalkot*	Nil	—0·8	Nil
	Kakinada	Nil	—0·5	0·1
	Maruteru*	Nil	—0·5	Nil
	Masulipatam	Nil	—0·4	Tr.
	Guntur*	Nil	—0·8	Nil
	Agri. College, Bapatla	...	...	...
	Veeravanam (College Farm)	...	...	...
Ceded Dists.	Kurnool	Nil	—0·2	Nil
	Nandyal*	Nil	Nil	Nil
	Hagari*	Nil	—**	Nil
	Siruguppa*	Nil	—0·2§	Nil
	Bellary	Nil	—0·2	Nil
	Rentichintala	Nil	...	Nil
	Cuddapah	Nil	—0·2	Nil
	Anantharajpet*	Nil	—0·5	Nil
Carnatic.	Nellore	Nil	—0·2	Nil
	Buchireddipalem*	Nil	...	Nil
	Madras	Nil	—0·3	Nil
	Tirurkuppam*	Nil	—1·5$	Nil
	Palur*	Nil	—0·6	Nil
	Tindivanam*	Nil	—0·7	Nil
	Cuddalore	Nil	—0·7	Nil
Central.	Vellore	Nil	—0·3	Nil
	Gudiyatham*	Nil	—0·4	Nil
	Salem	Nil	—0·5	0·1
	Coimbatore (A. C. R. I.)*	Nil	—0·3	0·1
	Coimbatore (C. B. S.)*	Nil	—0·5	Nil
	Coimbatore	Nil	—0·5	Nil
	Tiruchirapalli	Nil	—0·4	Tr.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	Nil	—0·8	0·5
	Aduturai*	Nil	—0·5	Nil‡
	Pattukottai*	Nil	—1·4	0·4
	Mathurai	Nil	—0·7	0·9
	Pamban	Nil	—0·7	6·2
	Koilpatti*	Nil	—1·5	1·9
	Palamcottah	Nil	—1·0	1·0
	Ambasamudram*	Nil	—2·2	1·2
West Coast.	Trivandrum	Nil	—1·5	0·3
	Cochin	0·3	—1·7	0·3
	Calicut	0·1	—0·3	0·1
	Pattambi*	Nil	—0·9	Nil
	Taliparamba*	Nil	—0·5	Nil
	Nileshwar*	Nil	—0·3	Nil
	Pilicode*	Nil	—0·6$	Nil
	Mangalore	Nil	—0·5	Nil
	Kankanady*	Nil	—0·6	Nil
Mysore & Coorg.	Chitaldrug	Nil	—0·2	Nil
	Bangalore	Nil	—0·4	0·3
	Mysore	Nil	—0·5	Nil
Hills.	Mercara	Nil	—0·8	0·1
	Kodaikanal	Nil	—1·8	1·0
	Coonoor*	Nil	—1·7	Nil
	Ootacamund*	Nil	—1·4	Nil
	Nanjanad*	Nil	—1·1	Nil

Note:—
(1) * Meteorological Stations of the Madras Agricultural Department.
(2) Average of ten years data is taken as the normal.
(3) $ Average of six years data for Tirurkuppam, and seven years for Pilicode is given as normal.
(4) § Actual figure is 0·03".
(5) $ Taluk office rainfall is Nil
(6) Tr. Trace, i. e., Rainfall below 0·04".
(7) ... Figures not available.

Weather Review for March 1949.

The western disturbance noted in the region of Punjab and the West United Provinces in the first week of March 1949 caused local showers in and near the hills of the Eastern Punjab and the West United Provinces.

This western disturbance induced towards the later half of the first week a secondary over Madhya Bharat and Vindhya Pradesh. This secondary caused a shallow 'low' over Chota Nagpur, South Bihar and the adjoining areas and this 'low' became less important the very next day. Even then it caused fairly widespread thundershowers in Upper Assam and a few thundershowers in Orissa, Gangetic West Bengal and Chota Nagpur.

Sind and the adjoining areas were under the effects of a western disturbance in the second week of the month under report. Punjab and the near-about regions experienced a number of shallow 'lows' and fresh mild western disturbances.

During the first ten days in the month, temperatures were generally below normal in Rayalaseema, Andhradesa and parts of Tamilnad. On 5—3—1949 and 24—3—1949 mist or fog occurred locally in the morning over Mysore Plateau. In the latter portion of the first fortnight and the subsequent days the day temperatures happened to be above normal and night temperatures were fluctuating, particularly in Andhradesa. Cuddapah was recording a high temperature of 106° to 107° for about four days from 14—3—1949.

The rainfall statement given above would show that rainless weather was experienced throughout the Madras Presidency barring the solitary exception of Cochin, which recorded only a total precipitation of 0·3".

M. B. V. N. & C. B. M.

Departmental Notifications

GAZETTED SERVICE—POSTING AND TRANSFERS

Name of Officers	From	To
Sri Balasubramanian, R.	On leave,	Cotton Specialist and Vice-Principal, Agricultural College and Research Institute, Coimbatore.
„ Jagannatha Rao, C.	Cotton Specialist, Coimbatore,	Superintendent, A. R. S., Hagari.
„ Subramania Pillai, M.	D. A, O., Nellore,	Regional Dy. D. A., Ellore.
„ Subramania Sarma, A. H.	Assistant Marketing Officer, Coimbatore,	Gazetted Assistant in Agriculture, Agricultural College, Coimbatore.
„ Sadagopan, V.	D. A. O. (on leave),	Assistant Marketing Officer, Coimbatore.
„ Suryanarayana, V.	D. A. O. (on leave),	Gazetted Assistant in Agriculture, Agricultural College, Bapatla.

SUBORDINATE SERVICE
APPOINTMENTS

The following are appointed as Upper subordinates in the Madras Agricultural Subordinate service under Rule 9(a) (i) of the General Rules (Emergency Provisions):—

Sri Anantha Rao, A.	Assistant, in millets, Coimbatore.
" Chandaiiah Naidu,	Farm Manager, Sugarcane Liaison Farm, Hospet.
" Jagannadha Rao, P.	Assistant in Millets A. R. S. Koilpatti.
Dr. Govindaswami, P. S.	Teaching Assistant in Economics, Coimbatore.
Sri Satyanarayan, S. B.	A. D., Ichapur.

POSTING AND TRANSFERS

Name of Officers	From	To
Mr. Azariah, M. D.	F. M., A. R. S., Wellington,	F. M., A. R. S., Nanjanad.
Dr. Bashu Saheb,	A. D., Dersi,	A. D., Koilkuntala.
Sri Bangarayya, M.	F. M., A. R. S., Anakapalle,	Assistant in Mycology, Coimbatore.
" Doraiswami, K.	F. M., A. R. S., Palur.	Special, A. D., Cuddalore.
" Govindan Nair, K. V.	F. M., A. R. S., Nileshwar,	Assistant in Oilseeds, Nileshwar.
" Habibullah, K. S.	A. D., Chicacole,	Special A. D., Viravalli.
" Jayaraman, M. V.	A. D., Arni,	Assistant in Meterology, Coimbatore.
" Krishnaiah, V. V.	A. D., Gudur,	P. P. A., Cuddalore.
" Kulandaswami, M. S.	A. D., Musri,	Special A. D., Karur.
" Kulasekharan, C. R.	Special A. D., Ayyangudi,	A. D., Vridachalam.
" Krishnaswami Ayyangar, M.	Assistant A. D., Rayachotti,	Assistant A. D., Vegetable Scheme, Madras.
Miss Kunjammâ Daivy,	Dairy Manager, Coimbatore,	Assistant in Millets, Coimbatore.
Sri Krishnamurthi, K.	F. M., A. R. S., Samalkota	Assistant in Agronomy, Anakapalle.
" Krishnamurthi, V.	Assistant in Mycology, Coimbatore,	A. D., Tirukoilur.
" Krishnamurthi, M. R.	A. D., Vridachalam,	Special A. D., Virdachalam.
" Krishnamurthi, G.	A. D., Vegetable Scheme, Madras,	A. D., Avanigadda.
" Krishnaswami Rao, T. B.	Assistant in Mycology, Coimbatore,	A. D., Avanashi.
" Kamath, H. N.	A. D., Coondapur,	Special A. D., Coondapur.
" Lakshminarayana Rao, K.	F. M., Siruguppa,	Assistant in Cotton, Adoni.
" Lakshmipathi Rao, T.	On leave,	Special A. D., Ramachandrapur
" Lakshmipathi Rao, S.	A. D., Punganur,	Special A. D., Punganur.
" Mohmad Baig,	A. D., Hindupur, (on leave),	P. A., to D. A. O., Anantapur.
" Muthukumarappa, S.	P. P., Assistant, Coimbatore,	A. D., Sugarcane Scheme, Villuppuram.
" Meenakshisundaram, M. N.	A. D., Tinnevelly,	Special A. D., Nilakottai.
" Muthuswami, S.	Assistant in Fruits, Coonoor,	Assistant in Banana Research Station, Maruthanakudy.
" Madhava Ayyar, S.	A. D., Tanjore,	A. D., Cuddalore.

	Name of Officers	From	To
Sri	Madhava Rao, S.	Assistant in Paddy, Coimbatore,	Special A. D., Crop Cutting Exporters, Vellore.
„	Narasimha Ayyar, B. S.	Assistant Agricultural Chemist, Coimbatore	Assistant in Chemistry, Compost Scheme, Coimbatore.
„	Nagabushana Rao, Y.	A. D., Narasapatam,	Special A. D., Grawavaram.
„	Natesa Ayyar, P. K.	A. D., Avanashi,	Special A. D., Coimbatore.
„	Narasimhamurthi, G.	A. D., Siruguppa,	Special A. D., Hospet.
„	Narasimhamurthi, B. L.	Assistant in Millets, Anakapalle,	Assistant in Millets, Narasaropet.
„	Narayana Reddy, B.	A. D., Hindupur,	Special A. D., Hindupur.
„	Narasimhalu, K.	A. D., Vayalpad,	Special A. D., Chittoor.
„	Rangaswami, G.	Assistant in Mycology, Coimbatore,	Assistant in Mycology, Kalpatta, Wynad.
„	Rajagopalan, K.	Assistant in Chemistry, Coimbatore,	A. D., Namakkal.
„	Ramanarai, K. S.	A. D., Crop Cutting Experiments, Calicut,	Special A. D., Mangalore.
„	Radhakrishna Reddy,	A. D., Sriperumpudur,	A. D., Vegetable Scheme, Madras.
„	Raghunatha Reddy, N.	A. D., Anantapur,	F. M., S. R. S., Gudiyattam.
„	Raghavan, N.	F. M., A. R. S., Nanjanad,	F. M., Botanical, Gardents, Ooty.
„	Raghavan, P. N.	Assistant in Entomology, Coimbatore,	A. D., Ariyalur.
„	Ramabadran, G.	Assistant in Millets, A. R. S., Koilpatty,	Assistant in Millets, Tirupattur.
„	Ratnakara Bhatkal,	Assistant A. R. S., Nileshwar,	A. D., Coondapur.
„	Ramaratnam, W. S.	A. D., Wandiwashi,	F. M., Sugarcane Liaision Farm, Pugalur.
„	Ramanadhan, G.	Assistant, in Chemistry,	A. D., Udumalpet.
„	Ramachandran, S.	On leave,	P. A., to D. A. O., Vellore.
„	Ramamohan Rao, K.	Assistant in Entomology, S. R. S., Anakapalle,	Assistant in Mycology, Chicacole.
„	Rama Rao, G.	A. D., Bobbili,	Special A. D., Bobbili.
„	Rama Rao, D.	F. M., Arakuvally,	Special A. D., Yellamancheli.
„	Ramanjaneyalu, S.	A. D., Koilguntla,	P. P., Assistant, Ellore.
„	Rama Rao, G. V.	A. D., Nandigama,	Special A. D., Pathapuram.
„	Rangamannar, D.	A. D., Rayadrug,	F. M., A. R. S., Siruguppa.
„	Rama Rao, M. V.	A. D., Kurnool,	Assistant in Fruits, Kodur.
„	Radhakrishna Menon,	F. M., A. R. S., Nileshwar,	Assistent in Oilseeds Cocoanut Nursery Scheme, Tindivanam.
„	Ramanathan, S.	Assistant in Millets, Guntur,	Assistant in Millets, Ongole.
„	Suryanarayanasarama, D.	A. D., Vegetable Scheme, Madras.	A. D., Rayachoti.
„	Somalingam, R.	Special A. D., Mannargudi,	A. D., Musri.
„	Sundararaman, M.	F. M., Botanical Gardens, Ooty,	A. D., Arni.
„	Sivasankaran Nair, V. T.	Assistant in Mycology, Ooty,	Special A. D., Crop Cutting Exporters, Calicut.

Name of officers	From	To
Sri Seshagiri Rao, M.	A. D., Rapalle,	Assistant in Fruits, Kodur.
,, Seshagiri Rao, K. V.	A. D., Hindupur, (leave),	A. D., Anantapur.,
,, Sundararajan, J. S.	Assistant in F. R. S., Kodur,	Assistant in Banana Research Station, Maruthanakudy.
,, Sadagopan, R.	Assistant in Millets Coimbatore,	Assistant in Millets, Ariyalur.
,, Subba Raju, A.	F. M., Sugarcane Liaison Farm, Samalkota,	F. M., A. R. S., Samalkota.
,, Srinivasa Rao, N.	Special A. D., Temple and Math Lands, Coimbatore,	Teaching Assistant in Agriculture, Coimbatore.
,, Sankaranarayanan, C.	A. D., Namakkal,	Special A. D., Namakkal.
,, Subramania Ayyar, R.	A. D., Adirampatnam,	A. D., Peravurni.
,, Suryanarayanamurthi, A.	A. D., Chandragiri,	Special A. D., Chandragiri.
,, Suryanarayana, Y.	A. D., Sugarcane Farm, Samalkota,	A. D., Hospet.
,, Subramanian, D. S.	Special A. D., for the Tamilnad Grama Sevak Vidyalayam, Kallupatti,	A. D., Periyakulam.
,, Seshagiri Iyer, C. S.	A. D., Ariyalur,	Special A. D., Jayakondan.
,, Tiruvengadan, C. R.	A. D., Gudiyattam,	Special A. D., Gudiyattam.
,, Thomas, M.	Special A. D., Pappanad,	F. M., A. R. S., Nileshwar.
,, Venkatachalam, K.	Assistant A. D., Cuddalore,	Assistant F. M., Palur.
,, Vasudeva Singh, B.	A. D., Madukkur,	A. D., Wallajah.
,, Venkatarama Iyer, S.	A. D., Mannargudi,	A. D., Mayavaram.
,, Venkataramana Rao, V. G.	A. D., Mayavaram,	A. D., Mannargudi.
,, Viswanathan, R.	A. D., Udamalpet,	Special A. D., Udamalpet.
,, Venkatarama Reddy,	F. M., Sugarcane Liason Farm, Hospet,	A. D., Gudur.
,, Venkataramana Reddy, G.	A. D., Madanapalle,	Special A. D., Madanapalle.
,, Veeraswami, R.	Assistant in Millets, Coimbatore,	Assistant in Millets, Tirupattur.

The following candidates who have been selected by the Madras Public Service Commission are appointed to *officiate* as upper subordinates in the posts shown against each with effect from the forenoon of the 18th April 1949,

Names	To
Sri Abdul Basheer	A. D, Koilkuntla.
,, Anthoni Reddi, Y.	A. D. Kurnool.
,, Appayyan, M. C.	A. D. Orthanad.
,, Appa Rao, V.	A. D. Nandigama.
,, Appa Rao, S.	F. M. Sugarcane Liaison Farm, Samalkota.
,, Appa Rao, K.	A. D. Nugur, E. Godavari.
,, Alwa, K. S.	A. D. Karkal.
,, Appa Rao, G. V.	A. D. Punganur.
,, Arumugavel, M. R.	Marketing Assistant Tiruchirappalli.
,, Appa Rao, A.	Assistant in Cotton, Nandayal.

Names	To
Sri Anavaradham, L	Assistant in Millets, Coimbatore.
,, Anjaneyalv Naidu, N.	Fruit Assistant, Kodur.
,, Arunachalam, S. A. M.	Assistant in Entomology, S. R. S. Anakapalli.
,, Balasubramaniam, P.	A. D. Pulivendala.
,, Bhanumurthi, K. K.	F. M. Sugarcane Station, Anakapalli.
,, Bhaskara Rao, V.	A. D. Bobbili.
,, Bhabu Rao, G.	Asststant in Paddy, Pattambi.
,, Bakthavathsalu, C. M.	Assistant Horticultural Training, Madras.
,, Brahmanna, N.	A. D. Allagadda.
,, Chakarapani, K.	A. D. Seethammapeta.
,, Chandrasekharan, N. R.	F. M. A R S Puttukottai.
,, Chathukutty Nambiar, M.	Assistant in Paddy, Coimbatore.
,, Durgaprasad, S.	A. D. Gurzala.
,, Dhakshinamurthi, V.	F. M. Arakuvalley.
,, Duraiswami, K.	S. A. D. Cuddalore.
,, Dharmalingaswami, P.	F. M A. R. S Guntur.
,, Ernest, R S.	F. M. A. R. S. Nanjanad.
,, Edwin Mangala Doss, D. I.	A. D Sivaganga
,, Gajapathi, V.	A. D. Omalur.
,, Gopalakrishnamurthi, A.	A. D. Tekkali.
,, Gopalakrishna, A.	A. D. Padapatnam.
,, Gopalakrishnan, R.	Assistant A. R. S. Pattambi.
,, Hanumantha Rao, A.	A. D. Harur.
,, Janardhana Rao, P.	A D Jammalamadugu.
,, Jayaraman, M. V.	Assistant in Meteorology, Coimbatore.
Mr. Jaleel Ahmed, N.	Assistan itn Mycology, Ootacamund.
Sri Koyamu, K.	F. M. A. R. S. Nileshwar.
,, Karim, B. A.	A. D. Siruguppa.
,, Kulasekharan, C R.	A D. Virddachelam.
,, Koteswara Rao, T.	A. D. Pattikonda.
,, Krishna Rao, D. V.	A D. Gudirada.
,, Krishnamurthi, V.	A. D Tirukoilur.
,, Krishnamraju, K.	A. D. Tenali.
,, Krishnswami Rao, T. B.	A. D Avanasi.
,, Krishnamurthi, K.	A. D. Gannavaram.
,, Kamalanathan, S.	Assistant in Cotton, A. R. S. Palur.
,, Kamalakara Rao, C.	Assistant in Entomology, Siruguppa.
,, Koteswara Rao, D.	Assistant in Mycology, Bapatla.
,, Lakshmipathi Rao, S.	S. A. D., Punganur.
,, Lakshmi Reddi, M.	Assistant in Cotton, Hagari.
,, Madhava Rao, S.	A. D., Crop Cutting Experiments, Vellore.
,, Meenakshisundaram, D.	Assistant in Paddy, Coimbatore.
,, Madhava Rao, S.	A. D., Madanapalli.
,, Muthukrishnan, C. R.	Fruit Assistant, Aduthurai.
,, Muthuswami, S.	Fruit Assistant, Aduthurai.
,, Madan Mohan Rao, G.	Assistant in Entomology, Coimbatore.
,, Muthukrishnan, T. S.	Assistant in Entomology, Coimbatore.
,, Muthukumaran, S.	Assistant in Entomology, Bapatla.
,, Manickaraja Samuel,	A. D., Sugarcane Scheme, Vellore.
,, Muthuraj, M.	Assistant in Mycology, Coimbatore.
,, [illegible], W. R.	A. D., Kodaikanal.

	Names	To
Sri	Nelliat, E. V.	F. M., A. R. S., Pilicode.
„	Narayanaswami, V.	A. D., Hindupur.
„	Narasimha Raja, K. A.	A. D.. Narasapatam.
„	Narasimha Rao, G. L.	(Dairy Manager), Bapatla.
„	Narasa Reddi, I.	A. D., Atmakur.
„	Narayans Reddi, M. S.	A. D., Nandyal.
„	Nagabhushana Rao, Y.	A. D.. Sugarcane Scheme, Gannavaram.
„	Narayana Rao, T.	A. D., Harpanahalli.
„	Narasimha Rao, M.	A. D., Rajampet.
„	Narasimha Rao, D. V.	Assistant in Millets, Siruguppa.
„	Nageswara Sarma, D.	A. D., Rapur.
„	Obulapathi Chowdary, S.	Assistant in Cotton, Narasarapet.
„	Pappa Rao, P.	Form Manager, Bapatla.
„	Purnachandara Rao, V.	A. D. Kanigiri.
„	Parthasarathi, G.	A. D. Sungavarapukota.
„	Pitchayya, B.	Farm Manager, Bapatla.
„	Prahlada Rao, G.	A, D. Penukonda
„	Prasada Rao, E. V.	A. D. Krishnadevipetta.
„	Ponnuswami, M. K.	Assistant in Entomology. Nellikuppam.
„	Rama Rao, B. V.	A. D. Yellavaram'
„	Ramasubbayya, K.	A D. Rayadrug
„	Ratnakar Bhatkal,	A. D. Coondapur.
„	Ramaraju, B. A.	F. M. Araku.
„	Ramanathan, G.	A. D Udamalpet.
„	Ramaswami, N.	A. D. Tiruppur.
„	Ramalinga Reddi, K.	A D. Tirupattur,
„	Ramachandaran, M.	Marketing Assistant. Coimbatore.
„	Raghunatha Reddi, D.	A. D. Krishnagiri.
„	Ramachandra Reddi, B.	F. M. Nandyal.
„	Ramakrishnaraju, K.	A. D. Chicacole.
„	Rajapadmanabhan. A. K.	A. D. Gingee.
„	Raghavendra Rao, J.	A. Gudiyattam.
„	Ramachandra Marar, P.	A. D. Kotagtri'
„	Ramanamurthi, G. V.	A. D. Bimlipatam.
„	Rama Mohan Rao, R. M. V.	A. D. Rapalli
„	Rajagopalan, V. T. R.	A, D. Villupuram.
„	Rajagopalan, K.	A. D. Namakkal.
„	Radhakrishnan, T. V.	Assistant in Cotton, Coimbatore.
„	Ramalingeswara Rao, M.	Assistant in Oil Seeds, Tindivanam.
„	Rathnam, C.	Assistant in Chemistry, Coimbatore.
„	Raghavan, P. N.	A. D. Aryalur.
„	Syed Sheriff, P.	A. D. Madukulatur.
„	Samuel Ponnayya, J. H.	A. D. Tinnevelly.
„	Srinivsa Rao, P.	A. D. Vayalpad.
„	Sriramulu, K.	A. D. Chandragiri.
„	Satyanarayane, T.	A. D. Tobacco Scheme, Sendarampatti.
„	Suryanarayana, T,	A. D. Polavaram.
„	Srinivaan, V.	A. D. Didigul.
„	Srinivasa Rao, V.	F. M. Hagari.
„	Sivaramakrishniah, Y.	A. D. Salur.
„	Sithapathi Rao, C.	F. M. A. R. S. Hagari.

Names	To
Sri Somalingam, R.	A. D, Musiri.
„ Sivasnakaran Nair, V. T.	A. D. Crop cutting experiments, Calicut.
„ Sundaram, V. P.	A. D, Cheyyar.
„ Subba Rao, P.	A. D. Chipurupalle.
„ Sambandam. C. N.	A. D. Nanguneri.
„ Satyanarayaswami G,	A. D. Badrachalam.
„ Suryanarayana, S.	F. M. A. R. S. Koilpatti.
„ Sankaranarayanan, C.	A. D. Sugarcane Scheme, Namakkal.
„ Satyanarayana, S. B.	A. D. Ichapur.
„ Suryanaranamurthi, V. V.	Assistant in Paddy A. R. S. Maruteru.
„ Sethuraman, S	Assistant in Millets, Coimbatore.
„ Sambasiva Rao, I. K.	Fruit Assistant. Mettuppalayam.
„ Samuel, D. M.	Assistant in Chemistry, Coimbatore,
„ Sundaram, N. V.	Assistant in Mycology, Coimbatore.
„ Siddalinga Reddi, G.	Assistant in Mycology, Coimbatore.
„ Sriramachandran, K.	Assistant in Mycology, Coimbatore.
„ Thomas, M.	F. M. A. R. S. Nileshwar.
„ Umamheswara Rao,	F. M. A. R. S. Samalkot.
„ Venkiah, P.	A. D. Tiruvannamalai.
„ Venkata Rao, M. (B.)	F. M. Central Form, Coimbatore.
„ Venkatapathi Rao, C.	A. D. Hadagalle.
„ Venkatarama Rao, G.	A. D. Sugarcane Scheme, Peddapuram.
„ Vittal Hegde, Y.	F. M. A. R. S. Nileshwar,
„ Viswanathan, A. R.	A. D. Gobichettipalayam.
„ Vaidyanatham, R.	A. D. Tenkasi.
„ Venkata Rao, M. (B. H.)	F. M. Araku.
„ Venkataraman, R.	Assistant. in Paddy, Aduthurai.
„ Venkatesan, C.	Fruit Assistant, Kodur.
„ Venugopal, S.	Assistant in Entomology, Coimbatore.

OBITUARY.

Prof. BIRBAL SAHNI, F. R. S. (1891 — 1949)

It is with great regret, we record the death of Prof. Birbal Sahni on 9—4—1949 at his residence in Lucknow.

In the passing away of Prof. Sahni India loses one of her foremost scientists, a great teacher, and a large-hearted humanitarian. It is tragic to contemplate that just a week prior to his death, the foundation stone of the Institute of Paleobotany to which the late professor intended to dedicate himself to the rest of his life, was laid.

MEMOIR.

Prof. Birbal Sahni was born at Bhera in the Punjab on 14th November in the year 1891. His father Prof. Buch Ram Sahni was a distinguished professor of Chemistry in the Punjab Uuiversity. The late Prof. B. Sahni had his early education in Lahore, and joined the Cambridge University in 1911 where he won many academic distinctions. He was a foundation scholar and later a life member of the Emmanuel College. He received the Sc. D. degree of Cambridge and the D. Sc. degree of London While in England he had the distinction of studying under the renowned scientist Sir A. C. Seward.

In 1919, he became Professor of Botany at the Benares Hindu University. A year later he joined the Punjab University. In 1921, he was appointed as Professor of Botany at the Lucknow University, and subsequently became the Dean of the Faculty of Science in that University. He was awarded the Barday medal of the Asiatic Society of Bengal for research in Biological Science in 1931. In 1936 he was elected as a Fellow of the Royal Society.

Professor B. Sahni was intimately associated with all the progressive Scientific Association in this Country and abroad, and was one of the founder members of the Indian Botanical Society which owes much to him. He was Vice-President of the Paleo-Botany Section at the 5th International Botanical Congress held in Amsterdam in 1935 and he represented India at the third centenary celebrations of the National History Museum in Paris in 1935. He was twice (1921, 1928) President of Botany section of the Indian Science Congress and once of the Geology section of that body (1926). He was the General President of the Congress in 1940, the subject of his address on the occasion being the Deccan Traps an episode of the Territory.

Prof. B Sahni won world distinction in two fields of Science, Botany and Geology. He dedicated his life to the Course of Science, and it was characteristic of him, that at the time of his death, his one thought was the future of the Institute of Paleobotany for which he had endowed all his fortune. It is a great pity that he died before the cherished object of his life could be fulfilled

A very great man has passed away, and it is difficult to fill the gap.